

REMARKS

Claims 1, 5, 6, 8-12, 17 and 20-27 are pending in this application. Claims 15-16, 18-19, and 28-32 have been withdrawn. Claims 1-5, 6, 8-12, 20 and 24 have been rejected. Claims 17, 21-23, and 25-27 have been allowed. Claims 5-6 and 9-12 are cancelled without prejudice. Claims 1, 20 and 24 are currently amended.

Claims 1, 5 and 8-12 have been rejected under 35 U.S.C. § 103(a) as being unpatentable over *Schetzina* (U.S. Patent No. 5, 351,255) in view of *Kuniyasu* (U.S. Patent No. 6,268,230).

Claims 5 and 9-12 have been cancelled without prejudice.

Claim 1 has been amended to recite:

- 1) the light-emitting layer contains $\text{In}(x_1)$, $\text{Ga}(y_1)$, $\text{Al}(1-x_1-y_1)$ and $\text{P}(0 \leq x_1, y_1 \leq 1, x_1+y_1 \leq 1)$, or contains $\text{In}(x_2)$, $\text{Ga}(y_2)$, $\text{Al}(1-x_2-y_2)$ and $\text{N}(0 \leq x_2, y_2 \leq 1, x_2+y_2 \leq 1)$, and
- 3) the bonding electrode is formed on the transparent electrode.

The optical heterostructure (light emitting diode) 11 of *Schetzina* contains Zn and Se, and it does not contain In, Ga, Al and P, or In, Ga, Al and N as recited in amended claim 1.

Further, although *Schetzina* discloses a transparent electrode formed on the optical heterostructure 11, *Schetzina* does not disclose or even suggest the bonding electrode formed on the transparent electrode as recited in amended claim 1.

As described in lines 14-17 on page 14 of the specification, the bonding electrode 3110 is formed on the transparent electrode 3109, so that stress strain applied to the active layer 3106 by the transparent electrode 3109 can be relaxed and the reliability can be improved. *Schetzina* does not provide this benefit.

According to the device of *Kuniyasu*, the cladding layers 23 and 25, and the active layer 24 contain Al, Ga and As, and, thus, *Kuniyasu* does not disclose or even suggest the light-emitting layer containing In, Ga, Al and P, or In, Ga, Al and N as recited in amended claim 1.

Furthermore, *Kuniyasu* does not disclose or even suggest a transparent electrode formed on the light-emitting layer, and therefore, *Kuniyasu* does not disclose or even suggest the bonding electrode formed on the transparent electrode as recited in amended claim 1.

The combination of *Schetzina* and *Kuniyasu* does not disclose or even suggest a light-emitting layer containing In, Ga, Al and P, or In, Ga, Al and N as recited in amended claim 1.

The combination of these references also does not disclose or even suggest a bonding electrode formed on a transparent electrode as recited in amended claim 1.

Lacking the disclosure or even suggestion of at least this claimed feature, neither *Schetzina* nor *Kuniyasu*, either individually or in combination, can render claim 1 unpatentable. Claim 8 depends on claim 1, and for similar reasons, neither *Schetzina* nor *Kuniyasu*, either individually or in combination, can render claim 8 unpatentable. Therefore, it is respectfully submitted that claims 1 and 8 are patentable over the references of record.

Claim 6 has been rejected under 35 U.S.C. § 103(a) as being unpatentable over *Schetzina* (U.S. Patent No. 5,351,255) in view of *Biing-Jye et al.* (U.S. Patent No. 6,169,294). Claim 6 has been cancelled without prejudice or disclaimer.

Claim 20 has been rejected under 35 U.S.C. § 103(a) as being unpatentable over *Schetzina* (U.S. Patent No. 5,351,255) in view of *Bour et al.* (U.S. Patent No. 5,977,612).

Applicant continues its assertion that claim 20 recites a semiconductor light-emitting diode, and a laser diode is not included in the scope of claim 20. Applicant notes that claim 20 recites a light-emitting diode and not a light-emitting device. Claim 20 has been amended merely to clarify the light extraction surface.

Claim 20 has been amended to recite in pertinent part "a light extraction surface includes a side surface of said semiconductor light-emitting diode."

The light-emitting diode of claim 20 has a shape that is a polygonal prism having at least four corners or a cylindrical cylinder and includes a light extraction surface that includes a side surface of the semiconductor light-emitting diode. These features are not disclosed or even suggested in *Schetzina* or *Bour et al.*, either individually or in combination.

Schetzina is described above. As understood, *Bour et al.* at best merely discloses a laser diode as shown in Figures 2(a) and 2(b) and described at column 6, lines 41-49. The upper distributed Bragg reflector (DBR) layer 114 allows the transmission of light from the laser. (Col. 5, lns. 28-31.) The laser diode of *Bour et al.* extracts light only from the top surface, and does not extract light from a side surface as recited in amended claim 20. Because the device of *Bour et al.* is not a light-emitting diode but a laser diode, it is necessary for *Bour et al.* to confine light inside the side surface of the laser diode. In contrast, the light-emitting diode recited in amended claim 20 includes a light extraction surface that includes a side surface of the semiconductor light-emitting diode. The extraction of light from the side surface improves light

extraction efficiency of the light-emitting diode. Lacking the disclosure or suggestion of at least this claimed feature, neither *Schetzina* nor *Bour et al.*, either individually or in combination, can render claim 20 unpatentable. Therefore, it is respectfully submitted that claim 20 is patentable over the references of record.

Claim 24 has been rejected under 35 U.S.C. § 103(a) as being unpatentable over *Schetzina* (U.S. Patent No. 5,351,255) in view of *Paoli et al.* (U.S. Patent No. 5,138,265).

Claim 24 has been amended to recite in pertinent part "a light extraction surface includes a side surface of said semiconductor light-emitting element".

Schetzina is described above. As understood, *Paoli et al.* at best merely discloses a laser having active quantum wires 288 formed on grooves 278 as shown in Figure 12. The grooves 278 are not formed to reflect light emitted from the active quantum wires 288, but are used to form the wires 288. (Column 12, lines 1-15). Thus, light is extracted from a certain limited face, because it has a general layer structure. However, the laser of *Paoli et al.* cannot improve the light extraction efficiency.

First, *Paoli* does not disclose an LED element, but discloses a laser device, and thus light is not extracted from a side surface. In contrast, light can be extracted from the side surface of the light-emitting element as recited in claim 24. Claim 24 has been amended merely to clarify the side surface.

It is again asserted in the Office Action that *Paoli et al.* discloses a LED having a corrugated interface between the contact layer 300 and cladding layer 296.

The wires 288 of *Paoli et al.* is not the "interface of said contact layer in contact with said first cladding layer is corrugated to have a gradient index" as recited in claim 24.

As an illustrative embodiment as described in lines 20-24 on page 28 of the specification, the interface of the layer 902 is corrugated to have the gradient index with the cladding layer 903, a light is reflected and scattered by the interface, so that the extraction efficiency can be improved.

In contrast, the V-shaped grooves of *Paoli* are formed on a surface of the active layer 288 not to reflect light emitted therefrom, but to form horizontal multiple Quantum wires and to confine light emitted therefrom. This is done because it is necessary to confine light in a laser device of *Paoli et al.*

Therefore, the layers 280 and 284 formed under the active layer 288, and the layers 292 and 296 above the active layer 288 can be manufactured by materials having low refractive index. As a result, a threshold current can be reduced. Namely, the V-shaped grooves of *Paoli et al.* are not formed to improve a light extraction efficiency, but are formed to confine light and reduce a threshold current.

Consequently, *Paoli et al.* does not disclose the contact layer whose interface is corrugated to have a gradient index or a light extraction surface that includes the side surface of the semiconductor light-emitting element as recited in claim 24.

Lacking at least these claimed features, neither *Schetzina* nor *Paoli et al.*, individually or in combination, can render claim 24 unpatentable. Therefore, it is respectfully submitted that claim 24 is patentable over the cited references.

It is submitted that claims 1, 8, 17, and 20-27 are allowable, and allowance and issuance of this application is respectfully requested.

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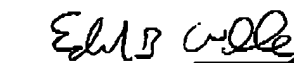
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